U.S. ARMY - BAYLOR UNIVERSITY GRADUATE

PROGRAM IN HEALTHCARE ADMINISTRATION

A STUDY TO DETERMINE THE EFFECTS OF SYSTEM CHANGES ON THE PRODUCTIVITY LEVEL AT THE NUTRITION CARE DIVISION USING A TOTAL FACTOR PRODUCTIVITY MODEL

A GRADUATE MANAGEMENT PROJECT

SUBMITTED FOR PARTIAL FULFILLMENT

FOR THE MASTER IN HEALTHCARE ADMINISTRATION

BY

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LIST OF TABLES

ABSTRACT

A study to determine the effects of system changes on the productivity level at the Nutrition Care Division using a Total Factor Productivity model. The productivity measures were calculated from historical data located in the Nutrition Care Division, Resource Management Division, and Facilities Management Branch for one year prior to and following the implementation of this system. Total Factor Productivity modeling allows the foodservice manager to make informed decisions as to the actions to be taken to improve the organization's efficiency and bottom line. A significant increasing trend in productivity was noted in the Total Factor Productivity ratios with $p < .05$ using the Cox and Stuart Trend Test. Thus, the null hypothesis was rejected and the alternate hypothesis that the implementation of the a la carte system did have an effect on productivity level at the Nutrition Care Division was accepted. No significant trend was found in the Partial Factor Productivity ratios. Total Factor Productivity modeling can be an invaluable predictive tool in determining productivity changes within this organization which can translate into financial benefits for the whole hospital.

CHAPTER 1

INTRODUCTION

For the better part of a decade, health care institutions have felt the pressure to control and reduce costs which in turn has necessitated improvements in the financial management of these facilities (Gutterman and Dobson 1986, and Howell 1991). The current political climate has brought a renewed emphasis on the issue of controlling costs and ensuring that health care facilities are as productive as possible. Managers of hospital foodservice departments are not immune from this phenomena and are under extreme pressure to compete for dwindling financial resources and to find ways to make their operations more effective and efficient (Chernoff 1993). Health care foodservice managers must seek innovative approaches to improve the profitability of their departments while simultaneously reducing costs.

Productivity measurement of health care services is one method of identifying potential areas for cost containment and cost reduction. Peter Drucker (1974) describes the paramount importance of productivity measurment as a management tool to determine the effectiveness and efficiency of an organization. Labor productivity has historically been used to determine the productivity of foodservice departments because of its large

percentage, usually 60%, of the total food service budget (Cocks 1974, Matthews, Zardain, and Mahaffey 1986, and Rose 1980). However, it has been well-documented in the business literature, that the use of a single ratio to determine overall productivity is not only naive but also inaccurate and disceptive (Brown 1988, Cocks 1974, and Cromwell and Pope 1989). Although hospital foodservice managers have recognized the requirement to measure and control multiple costs in their operations, an integrated model to measure total productivity is seldomly, if ever, used (Brown and Hoover 1991).

One tool for measuring overall productivity in a foodservice operation is a manufacturing based model known as the Total Factor Productivity (TFP) model (Brown and Hoover 1991). The TFP model compares outputs to a full gamut of inputs (Brown 1988). Measuring TFP can serve several important functions such as comparing the efficiency of two or more micro or macroeconomic units (Cocks 1974). The inclusion of changes in capital inputs, for instance, moves the TFP model considerably closer to an ideal measure of efficiency because it is more comprehensive in nature (Cocks 1974). This model can simplify the evaluation of the productivity for a foodservice department in relation to all resources used (Brown and Hoover 1991).

The TFP model can be utilized to determine whether productivity improvements in one resource, such as labor, can result in productivity declines or improvements in other resources including, but not limited to, food costs and supply costs. This will enable the hospital foodservice manager to make informed assessments of whether the productivity changes in a single resource category had a positive or negative impact on the department's overall productivity level.

Since the implementation of the a la carte system in April of 1992, the Nutrition Care Division (NCD) at Irwin Army Community Hospital (IACH) has undergone operating changes which could impact on the organization's productivity. Currently, there is no mechanism in place to evaluate the NCDs productivity. A comprehensive method to determine productivity levels would enable an identification of past and present productivity performance.

Examples of potential inefficiencies in productivity in the NCD at IACH are in the areas of food costs, labor costs, other operating expenses, inventories, and capital. Additionally, IACH is participating in the Coordinated Care Program, a managed care concept. Cost savings generated in any department, such as the NCD, will help to offset the 14% decrease in the capitation rate at IACH from $1194 to $1024.

Statement of the Management Problem

Due to the lack of performance measures in the NCD, it is virtually impossible to evaluate the productivity changes resulting from the a la carte system implementation. The use of an integrated model to measure total factor productivity would enable the food service manager to evaluate productivity changes resulting from the implementation of the a la carte system.

Literature Review

Although a primary concern of foodservice managers should be the productive use of a variety of resources such as labor, food, energy, and equipment, many managers do not typically complete a comprehensive productivity analysis (Sumanth 1981, and Chew 1988). In the past, labor represented the most widely used measure for overall productivity albeit it was only one of several resources used to produce goods and services. For instance, the labor statistic of meals per labor hour assesses only the impact of labor changes on labor productivity and has proven to be an inadequate measure of overall foodservice departmental efficiency (Brown and Hoover 1990). Researchers have shown that by using a single ratio to evaluate an organization's performance is not only erroneous, but can prove hazardous to the organization's financial health (Viscione 1984). However, the U.S. Bureau of Labor

Statistics continues to employ the productivity measure of output per labor hour at the national level (Brown and Hoover 1988).

Numerous research studies, conducted in the business arena, demonstrated that evaluation of an organization's productive efficiency based on a single ratio can be inaccurate and misleading (Brayton 1983, Brown and Hoover 1991, Cocks 1974, Felix 1984, and Miller 1984). As with any management indicator, labor should not be the sole criteria used to evaluate the productivity of an operation. To get a more complete picture of the total operation, a more comprehensive model should be applied.

A more thorough method to use in evaluating the overall productivity of an organization is the Total Factor Productivity model first proposed by Kendrick (1984) for use in an industrial setting. Kendrick recognized the limitations in evaluation of the efficiency of a company based solely on labor productivity as was used by the Bureau of Labor Statistics. Kendrick's model includes both partial and total productivity ratios. He suggests that the productivity ratio be expanded to include four categories of resources: labor, materials and purchased services, utilities, and capital (Kendrick 1984).

The TFP model uses a host of productivity ratios to assess overall organizational efficiency (Brown and Hoover 1991). The

essential features of Kendrick's TFP model included measurement of output and input data over time, selection of a base period and conversion of current dollars to constant dollars, and determination of productivity measures as shown by a ratio of outputs to inputs (Kendrick 1984).

Adam, Herschauer, and Ruch (1986) have extended Kendrick's model to encompass a quality component and have successfully measured productivity in various service firms.

Cromwell and Pope (1989) discuss the use of Total Factor Productivity measures in updating Prospective Payment System rates. Their equation included a measure for capital, labor, and an index of multifactor productivity change.

Several researchers have demonstrated the usefulness of the TFP model in conjunction with partial factor productivity ratios to be both a comprehensive and thorough method to determine overall productivity (Brayton 1983, Miller 1984, Felix 1984, Hayes and Clark 1985, 1986). Total Factor Productivity modeling permitted identification of lost profit opportunities, productivity declines in materials and capital, and comparison of labor productivity improvements with changes in total productivity (Brown and Hoover 1991).

Cocks (1974) used a TFP model with the intent of using it to compute the rate of change in TFP for an individual manufacturing corporation. He felt that the TFP model allowed the most direct comparison of rates of change of inputs and the subsequent change in total factor productivity. He also noted the importance in which productivity and efficiency of resources used are related to product pricing and price competition.

Brown (1988) was interested in applying the TFP model in the foodservice operation to determine overall productivity using a variety of resources including labor costs, food costs, energy costs, and equipment costs. The essential features of Kendrick's TFP model were incorporated into a TFP model for hospital foodservice operations by Brown. Each feature was translated into terminology and variables appropriate to a foodservice operation. A TFP ratio and a series of partial factor productivity ratios compose the TFP model. In her study, Brown tested the usefulness of the TFP model in four hospital foodservices. She found that the TFP model was feasible for a foodservice operation due to its predictive equations for four partial factor productivity ratios and for overall performance of a foodservice department. Brown also found that the TFP modeling overcomes the boundaries of using one single ratio by providing an assembly of ratios uniquely

suited to evaluate the productivity of all resources. The TFP model could provide managers with a more comprehensive analytical technique than is possible with partial measures used alone (Brown 1988).

The use of a comprehensive model that encompasses all inputs and outputs associated with an organization, such as the TFP model, could allow the user to manipulate resources to enhance overall efficiency (Brown and Hoover 1990).

Purpose

The purpose of this study was to evaluate the productivity level of the Nutrition Care Division at Irwin Army Community Hospital one year prior to and following the implementation of the a la carte system with the use of a Total Factor Productivity model. This study also determined if changes in productivity could be attributed to this system change. The null hypothesis states that the implementation of the a la carte system had no effect on the productivity level of the NCD. The alternate hypothesis states that the implementation of the a la carte system had an effect on the productivity level of the NCD. The independent variable was the a la carte system, whereas the dependent variable was productivity as measured by the Total Factor Productivity model. The variables measured as inputs

included food costs, labor costs, supply costs, utilities, capital investment, and other operating expenses. The variables measured as outputs included revenues from food sales in the categories of inpatient meals served, subsistence in kind meals served, and cash paying customers. This research comprehensively evaluated productivity measures at regular intervals within the organization.

CHAPTER 2

METHODS AND PROCEDURES

The research method chosen for this project was quantitative in nature. This research design enabled intertemporal comparisons of productivity to be made within the NCD at IACH. A longitudinal study of productivity measures identified monthly productivity trends with the use of data collected from a period of one year prior to and one year following the implementation of the a la carte system.

Data Collection and Processing

The use of standardized data collection forms helped in the calculation of total and partial factor productivity ratios. Sample forms are located in Appendix A.

Data Format and Processing

Data was collected from historical records maintained in the NCD and Resource Management Division (RMD) and it was entered onto the appropriate form (See Appendix A). I compared all manually copied data against the original records to insure accuracy. Data that was not available in the foodservice operation was obtained from RMD, or Facilities Management Branch as appropriate. I collected the general information describing the foodservice

operation and factors that might impact productivity from interviews with the Chief, Nutrition Care Division.

I collected output data in the form of monthly revenues. Revenues included inpatient meals served, subsistence in kind meals served, and cash paying customers. The surcharge was also included in the total dollar amount.

The data collected was typed into the computerized foodservice TFP model, checked for accuracy, and corrections were made as required.

October of 1991 was the base period month for constant dollar calculations. This month was selected because October represents a typical month (no holidays) for foodservice operations (Brown 1988).

I adjusted outputs and inputs to constant dollars using either price indices or base rates determined from October 1991 data. Base rates were calculated using the following formula:

$$\text{current dollars} \times \frac{\text{base period index}}{\text{current period index}} = \text{constant dollars}$$

Both consumer and producer price indices published by the U.S. Bureau of Labor Statistics were used. I used consumer price indices to adjust food sales revenues. Producer price indices were used to convert food costs, capital investment, utilities

expenses, and supply costs data into constant dollars. I used base rates to determine outputs expressed as monthly revenues.

Labor is the only category of resource inputs converted to constant dollars using a base rate. For various catergories of labor, base labor rates were determined. I used standard federal pay schedules in effect in October of 1991 to determine average labor rates. Labor benefits, computed using actual figures were added to the standard pay schedules. I adjusted the structure of the labor force with the addition of two cashiers needed to support a la carte implementation.

I valued current assets at the rate-of-return on investment expected for the facility. Due to the low risk associated with government investment, a social discount rate of 8% was used (Brown 1988). I determined the annual rate-of-return by dividing by twelve to obtain a monthly rate-of-return on investment.

I estimated the value of fixed assets by using the depreciation of capital equipment. Capital equipment data was obtained from the NCD hand receipt that contains all capital equipment present in the NCD. The hand receipt contains the date of purchase, original purchase price, and an anticipated replacement date for each piece of equipment. I entered this data into the TFP model to determine capital equipment depreciation.

Statistical Analysis

The Cox and Stuart test (Conover 1980), a nonparametric test, was used to evaluate the predictive effect of a system change on total factor and partial factor productivity trends (Brown 1988). Statistical significance was established at $p < .05$.

Validity and Reliability

I attained validity and reliability of the data by the use of standardized data collection techniques. All data was from original source data as opposed to secondary source data. The assumption is that the retrospective data is accurate.

Project Time Line

The project consisted of three phases. The first phase involved simulating LTC Brown's R-Base System V decision support program with Borland's Quattro Pro for Windows version 5.0 and data collection of input and output data. This phase commenced on 4 November 1993 and terminated on 17 December 1993.

Phase two encompassed the data input and statistical analysis. This phase commenced on 3 January 1994 and terminated 21 February 1994.

The final phase of the project included the formulation of the results, discussion, conclusions, recommendations, and the

completion of the GMP. This phase commenced on 22 February 1994 and terminated 18 March 1994.

CHAPTER 3

RESULTS

Overall results provide evidence that the implementation of the a la carte system did in fact effect the productivity of the Nutrition Care Division at Irwin Army Community Hospital using a Total Factor Productivity model. Of the 24 month sampling, a significant increasing trend in productivity was found when applying the Cox and Stuart Trend Test as noted in Table 1.

TABLE 1

RESULTS OF TFP TREND ANALYSIS

	TFP RATIOS		Trend Indicators by Comparison Period*
	Pre	Post	(n=12)**
April	.153	.194	(+)
May	.177	.217	(+)
June	.187	.243	(+)
July	.196	.258	(+)
August	.210	.235	(+)
September	.197	.211	(+)
October	.210	.211	(+)
November	.214	.206	(-)
December	.213	.182	(-)
January	.200	.216	(+)
February	.201	.202	(+)
March	.211	.233	(+)
			T=10

* Trends were tested using Cox and Stuart Trend Test. Statistical significance was established at alpha = .05, where (+) indicates positive trend, (-) indicates negative trend. For n=12, the probability of .0193 corresponds to values of T greater than or equal to 12 - 2 = 10. Thus, TFP is significant at $p < .05$.

** Twelve pairs were analyzed using data from pre and post a la carte implementation.

The twelve pairs of TFP ratios from April 1991 to March 1992 April 1992 to March 1993 data were compared against each other using the Cox and Stuart Trend Test. Ten of the twelve months showed a positive increasing trend. This demonstrated a probability of .0193, thus showing a significant difference between the two sets of data. The null hypothesis of no change was rejected and the alternate hypothesis that the implementation of a la carte did change productivity at the NCD during the year following its implementation was accepted.

A graphic representation of the increasing trend in the TFP ratios in figure 1, Illustrations section. Figure 2, Illustrations section, presents the results of the TFP trend analysis in a histogram format.

The results for the Cox and Stuart Trend Test on Partial Factor Productivity (PFP) ratios for labor costs shows no significant increasing or decreasing trends as noted in Table 2. The PFP ratio is an extension of the TFP Model using the same output value but only labor costs as the input. This helps to evaluate whether changes in labor had any effect on productivity trends. Labor costs were used because they represent the largest percentage of inputs.

TABLE 2

RESULTS OF PFP RATIOS FOR LABOR TREND ANALYSIS

	PFP RATIOS		Trend Indicators by Comparison Period*
	Pre	Post	(n=12)**
April	.199	.247	(+)
May	.211	.281	(+)
June	.223	.309	(+)
July	.242	.353	(+)
August	.260	.308	(+)
September	.254	.301	(+)
October	.261	.262	(+)
November	.271	.264	(-)
December	.262	.230	(-)
January	.256	.278	(+)
February	.273	.260	(-)
March	.275	.311	(+)
			T=9

* Trends were tested using Cox and Stuart Trend Test. Statistical significance was established at alpha = .05, where (+) indicates positive trend, and (-) indicates negative trend. For n=12, T must be greater than or equal to 12 - 2 = 10. Thus, the PFP ratios for labor trend analysis are not significant.

** Twelve pairs are analyzed using data pre and post a la carte implementation.

The PFP ratios for labor for April 1991 to March 1992 were compared with April 1992 to March 1993 data using the Cox and Stuart Trend Test. Nine of the twelve months showed an increase in productivity, however, this was not sufficient to show a significant difference between the two sets of data. For n=12, there must be ten or more pairs that show the trend or no significance is found.

A graphic representation of the PFP ratios for labor is located at figure 3, Illustrations section. Figure 4,

Illustrations section, shows the results of the PFP ratios for labor trend analysis in a histogram format.

Table 3 illustrates the descriptive statistics for the TFP ratio and the PFP ratio for labor concerning mean, median, mode, and minimum and maximum values. Figure 5, Illustrations section, compares the TFP ratios with the PFP ratios for labor in histogram format.

TABLE 3

DESCRIPTIVE STATISTICS FOR TFP RATIO AND PFP RATIO FOR LABOR

	TFP Ratio	PFP Ratio for Labor
Mean	.215	.283
Median	.211	.275
Mode	NA	NA
Minimum	.153	.199
Maximum	.258	.363

The Total Factor Productivity model allowed for visualization of the relationships between total factor productivity and partial factor productivity for labor inputs under management control as indicated in Figure 5, Illustrations section.

The use of the Total Factor Productivity ratio provides a comprehensive view of operational efficiency over time. The TFP model allows the foodservice manager to manipulate the inputs such

as food, inventories, and capital in order to make adjustments to the overall efficiency of the organization.

This information is not only pertinent to the NCD, due to the lack of performance measurement, but also to the hospital because of the ever increasing demand to improve efficiency and profitability. If the NCD can improve productivity and show cost savings, it could benefit the whole hospital.

The TFP model enables the Chief, Nutrition Care Division to determine whether productivity improvements in one resource, such as supplies, can result in productivity changes in other resources. In turn, this will permit an informed evaluation of the department's overall productivity and potential areas of improvement.

CHAPTER 4

DISCUSSION

Total Factor Productivity

The implementation of a la carte had a significant effect on Total Factor Productivity trends in the NCD at IACH as noted in Table 1, Chapter 3. This information is displayed graphically at figure 1 and figure 2, Illustrations section. As noted in figure 1 and figure 2, starting in April of 1991 through August of 1991, there appears to be a steady increasing trend in the TFP ratios. This appears to be a function of increased food reimbursement and not a deliberate management intervention. In September of that year, there was a decrease in productivity resulting from increased year-end purchases which occurs again in September of 1992. No other dramatic changes in productivity were noted until a la carte implementation in April 1992.

Productivity trends increased sharply from April 1992 until July 1992. This marked increase in productivity may have resulted partly due to an increase in surcharge as a result of a la carte and simply as a result of an increased interest in the new system. August 1992 through December 1992 resulted in a steady decrease in productivity. This decrease in TFP may have resulted from an increase in supply and labor costs stemming from a la cart

implementation. January through March 1993 showed a staggered increase in productivity generated mainly by an increase in revenues.

With all of these individual factors in mind, the post a la carte TFP figures were still significantly higher the year following its implementation than they were the year preceding implementation. Thus, a combination of factors resulting from a la carte implementation had a positive effect on TFP ratios. TFP modeling allows the foodservice manager to assess unique factors intertemporally to determine possible causes for productivity changes.

Partial Factor Productivity

The results of the PFP trend analysis for labor shows that there were no significant changes as noted in Table 2, Chapter 3. Figure 3 and figure 4, Illustration section, denotes the data graphically. Although, there was an increase in labor costs during the two year period, when comparing pre and post a la carte implementation data the change was not significant. As noted with the TFP ratios, the PFP ratios for labor also had a steady increase from April 1991 to August 1991 but then remained fairly constant until April of 1992.

April 1992 through July 1992 showed a sharp increasing trend in PFP ratios for labor. This again resulted from an increase in outputs as increased revenue resulting partly from interest in the new system and an increase in surcharge revenues. A steady decline in PFP ratios for labor is noted from August until December 1992 resulting from increase in labor costs and a decrease in revenues as was noted in the TFP trends as well.

Descriptive Statistics

As noted in Table 3, Chapter 3, the mean value for the PFP ratios for labor is higher than the TFP ratios. This is to be expected since the sum of the labor costs is substantially less than the total costs of all the inputs. Thus, when determining PFP ratios, the overall productivity values will be higher because the denominator is smaller. The rest of the descriptive statistics demonstrated that same phenomenon.

Figure 5, Illustration section, shows in histogram format the comparison between TFP ratios and PFP ratios for labor. It would be evident that since labor costs account for almost 70% of total inputs, that a change in labor costs would coincide with a change in TFP ratios. This phenomenon is readily apparent in Figure 5 with PFP ratios for labor mirroring the effects in TFP ratios. However, since PFP trends for labor were not found to be

significant, that a combined effect of the other inputs and outputs effected TFP trends. Thus, it is imperative that a foodservice manager track labor usage along with the other input factors to determine the effects of TFP trends and not merely labor costs alone.

CHAPTER 5

CONCLUSIONS

This research project's aim was to determine whether or not a la carte implementation had any effect of the productivity level at the Nutrition Care Division at Irwin Army Community Hospital. The conclusion drawn from this study is that TFP modeling can be used to predict changes in productivity based on a system change such as a la carte implementation. Factors under management control such as labor, supplies, utilities, capital expenses, and food expenses can be manipulated to effect overall TFP ratios. Although labor costs represent a large portion of total inputs, the other inputs and outputs also play a role in TFP trends. Thus, it would behoove the foodservice manager to track all inputs and outputs to determine what changes need to be implemented in these factors in order to secure a positive trend increase in TFP ratios for the organization.

Total Factor Productivity modeling allows for a comprehensive analysis of productivity changes and relationships between resources than is available from evaluating one single variable such as labor costs. In addition to monitoring overall productivity, the productive performance of each resource variable should be assessed at regular intervals. An analysis of partial

factor productivity ratios could aid the foodservice manager in determining areas that warrant management intervention.

Once this model has been setup for the organization, updating and completing "what if" scenarios is facilitated and permits managers to make decisions based on more thorough information.

The use of the TFP model can be an excellent management tool to track and control resources.

CHAPTER 6

RECOMMENDATIONS

Based on the findings of this study, the need to track productivity trends in a foodservice arena was emphasized. Without a method to track productivity, foodservice managers are incapable of determining what variables are increasing or decreasing productivity and to what extent. I recommend that this study be continued in the NCD at IACH to evaluate TFP changes for two to three years post a la cart implementation. With data on the effect of input and output changes on the TFP ratios, the foodservice manager can better control these resources to improve overall operational effectiveness and efficiency.

I would also recommend that the foodservice manager run "what if" scenarios concerning input data to determine what mix of controllable resources generates the best TFP profile. Employees should also be educated on the importance of conserving supplies, overtime, and raw food commodities due to their potential deleterious effect on the TFP ratio.

Overall, TFP modeling can be a useful tool that enables managers to comprehensively evaluate their organization's efficiency over time.

Appendix A

Data Collection Form

Facility _____ Month _____ Year _____

OUTPUTS:	Monthly Count	Weekday Avg	Week-end Avg
Patient Meals			
Other feedings			
Supplements			
Monthly Cafeteria Cash Sales			
Monthly Catering Cash Sales			
Federal Facilities:			
Patient Meals			
Non-Patient Meals			
Patient Rations			
Non-patient Rations			
Supplements			
Other feedings			

Managerial and Organizational Variables
Time Series Variables

Facility————	Mon/Yr	Mon/Yr	Mon/Yr	Mon/Yr	Mon/Yr
Hours worked per month by employee category					
Top Management					
Managerial Level					
Supervisory Level					
Clerical					
Food Service Workers					
Number of non-civilian employees					
Number of civilian employees					
Monthly number of full time employee hours					
Monthly number of part time employee hours					
Hours of Employee Training per month					
Hours of overtime per month					
Monthly Patient Census					
Monthly Count of Hospital Employees					
Average Length of Patient Stay					
Additional equipment investment per month					

Events Anticipated to Affect Productivity

Facility ———————— (Data to be collected by interview)

Event	Date Initiated	Date Terminated	Duration	Description/ Comments
Menu Characteristics				
Menu Style:				
Change from cycle to other format				
Change from other format to cycle menu				
Change length of cycle menu				
Selective to non-selective menu				
Non-selective to selective menu				
Major Menu Changes:				
Reorganization of meals				
<50 additions				
<50 deletions				
Change in average number of choices offered per menu				

Events Anticipated to Affect Productivity

Facility ———————— (Data to be collected by interview)

Event	Date Initiated	Date Terminated	Duration	Description/ Comments
Technological Change:				
Introduction of Computer assisted systems				
Major new equipment acquisition				
Management Changes:				
Personnel changes				
Director				
Upper Management				
Supervisory				
Budget Restrictions				
Labor				
Food supplies				
Other supplies				
Equipment purchases				
Utilities				
Physical Plant				

Data Collection Form

Facility———— Month———— Year————

MATERIAL:	Monthly Dollars Purchased		Monthly Dollars Used	
Food Supplies				
Other Supplies				
CAPITAL COSTS:	Allocated Monthly Costs			
Facility expense				
Other overhead				
Facility Renovation				
EQUIPMENT COSTS:	Date Purchased	Purchase Cost	Depreciable Life	Useful Life
Capital equipment				
Item 1				
Item 2				
.....				

Data Collection Form

Facility———— Month———— Year————

	Current Dollar Value			
Inventories:				
Food Supplies				
Other Supplies				
Prepared Foods Inventory				
ENERGY:	Units used or allocated	Base Period Rate	Current Period Rate	Total Costs
Electricity				
Gas				
Sewer				
Steam				
Water				

ILLUSTRATIONS

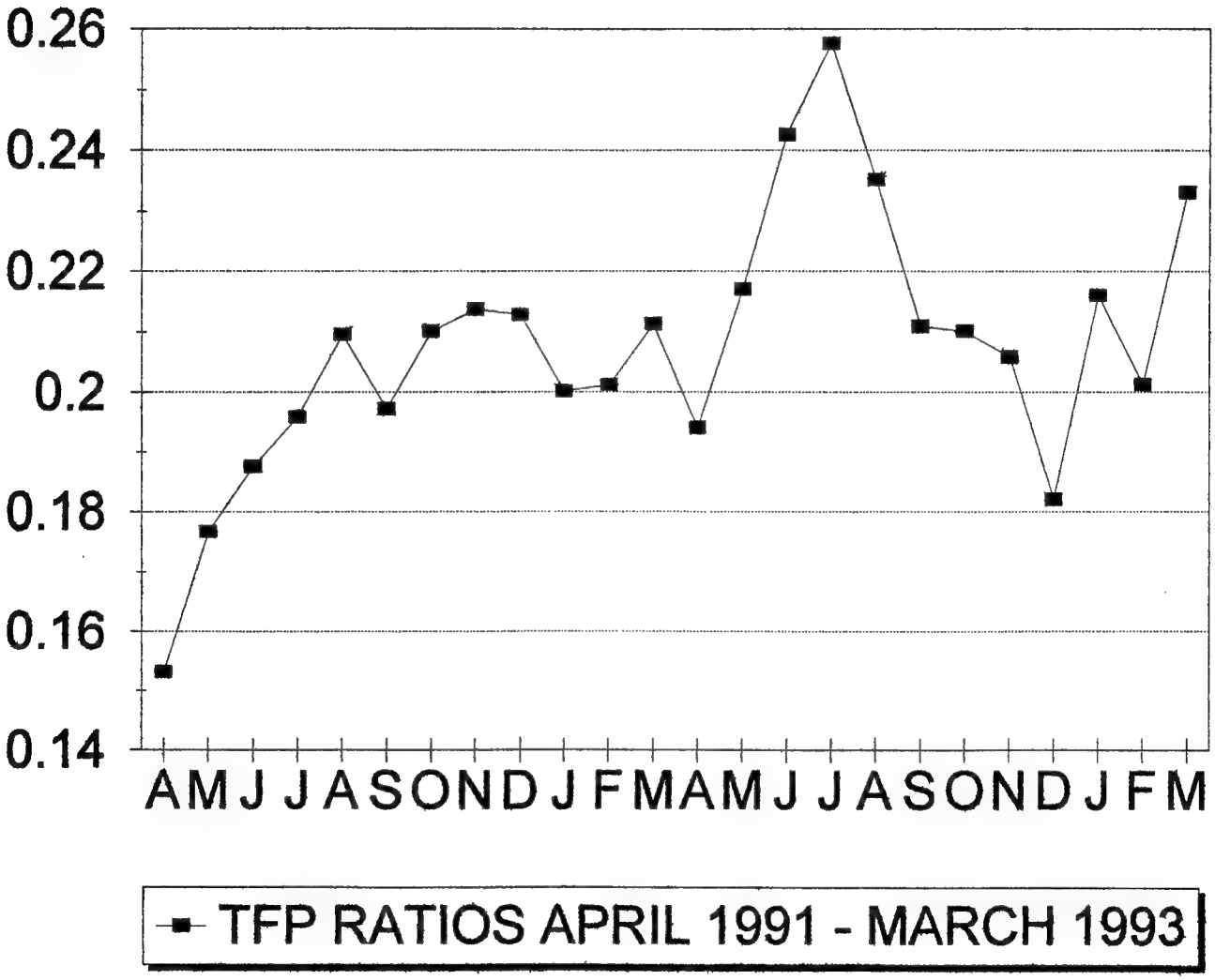

Fig. 1. Total Factor Productivity Ratios

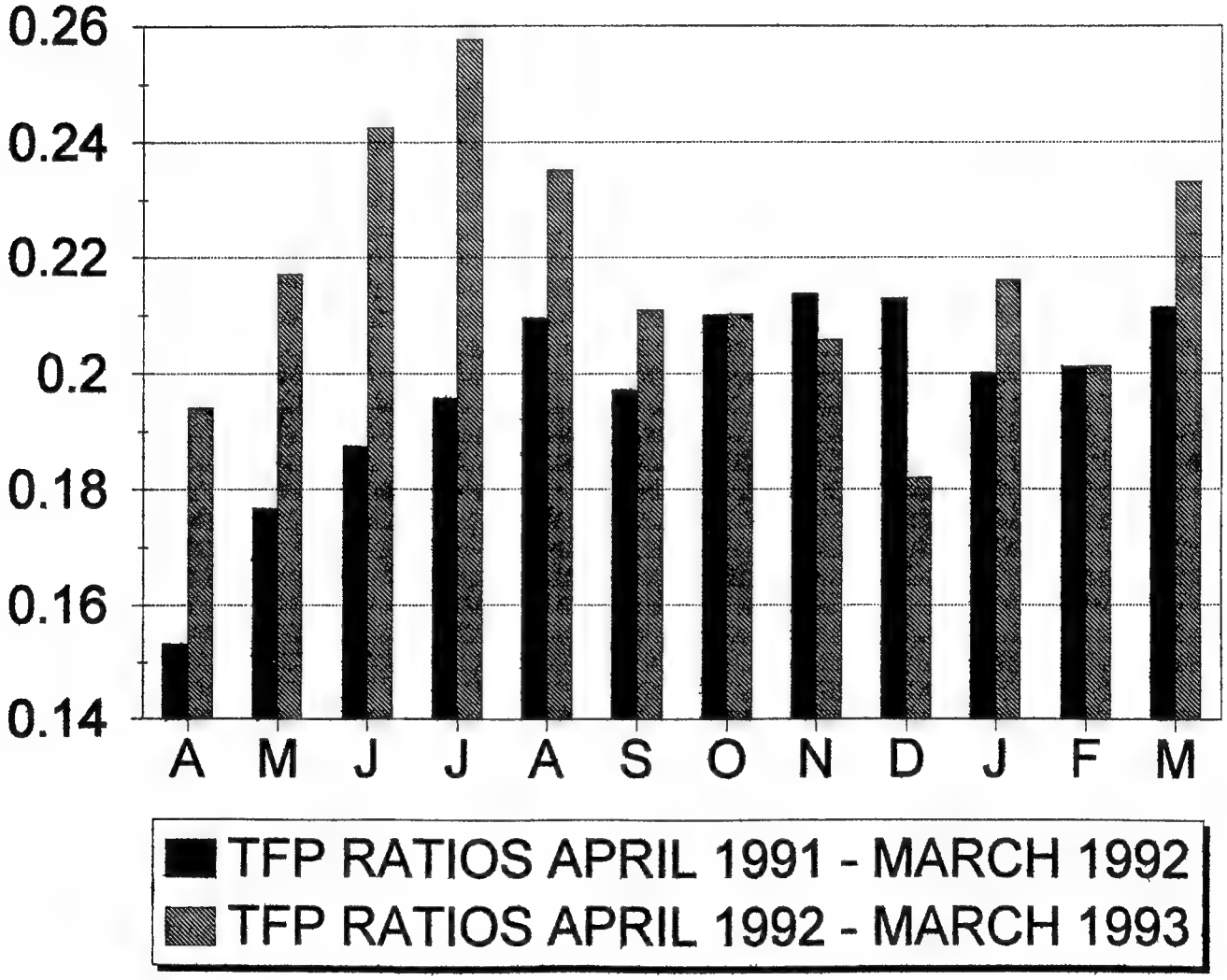

Fig. 2. Total Factor Productivity Ratios

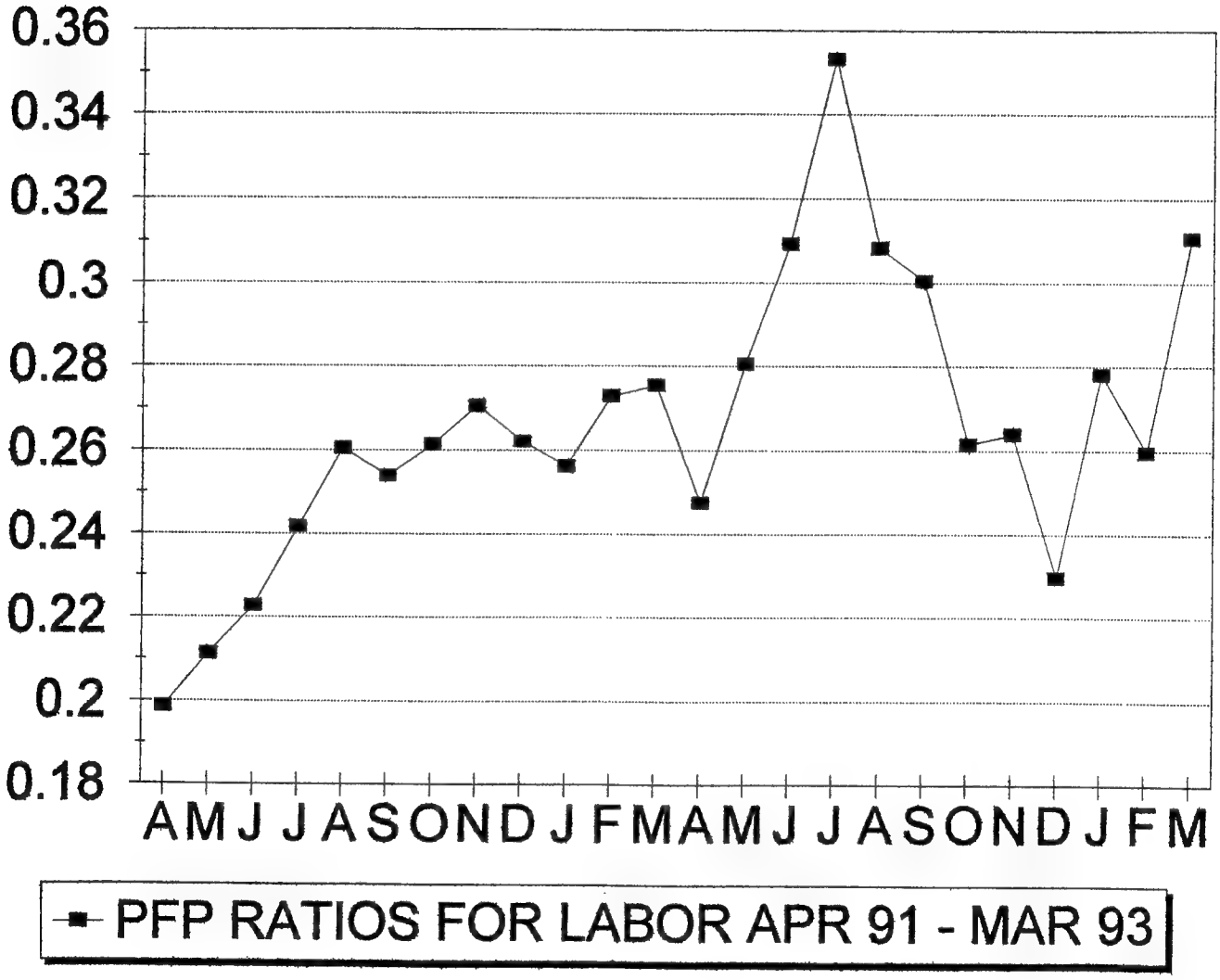

Fig. 3. Partial Factor Productivity Ratios

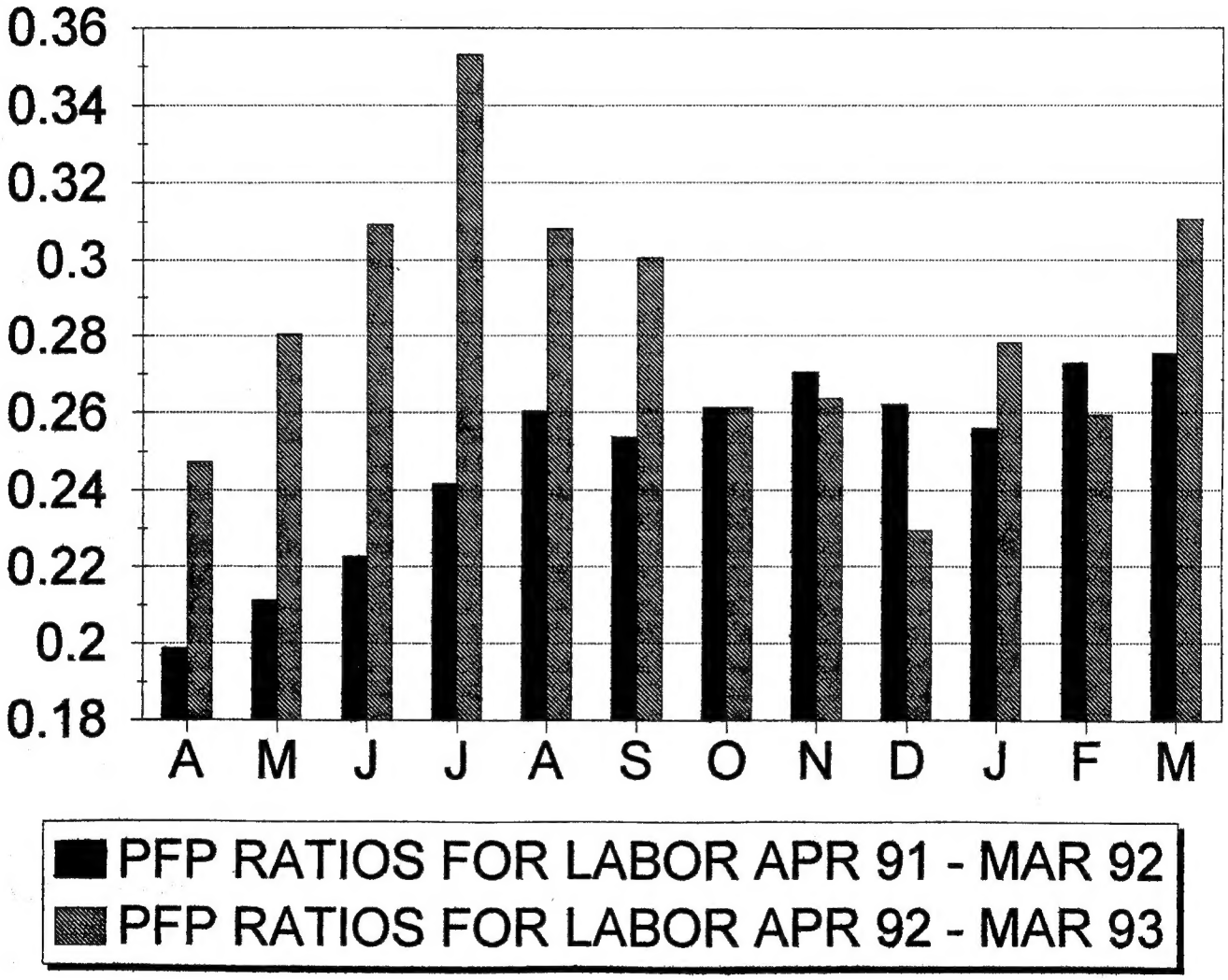

Fig. 4. Partial Factor Productivity Ratios

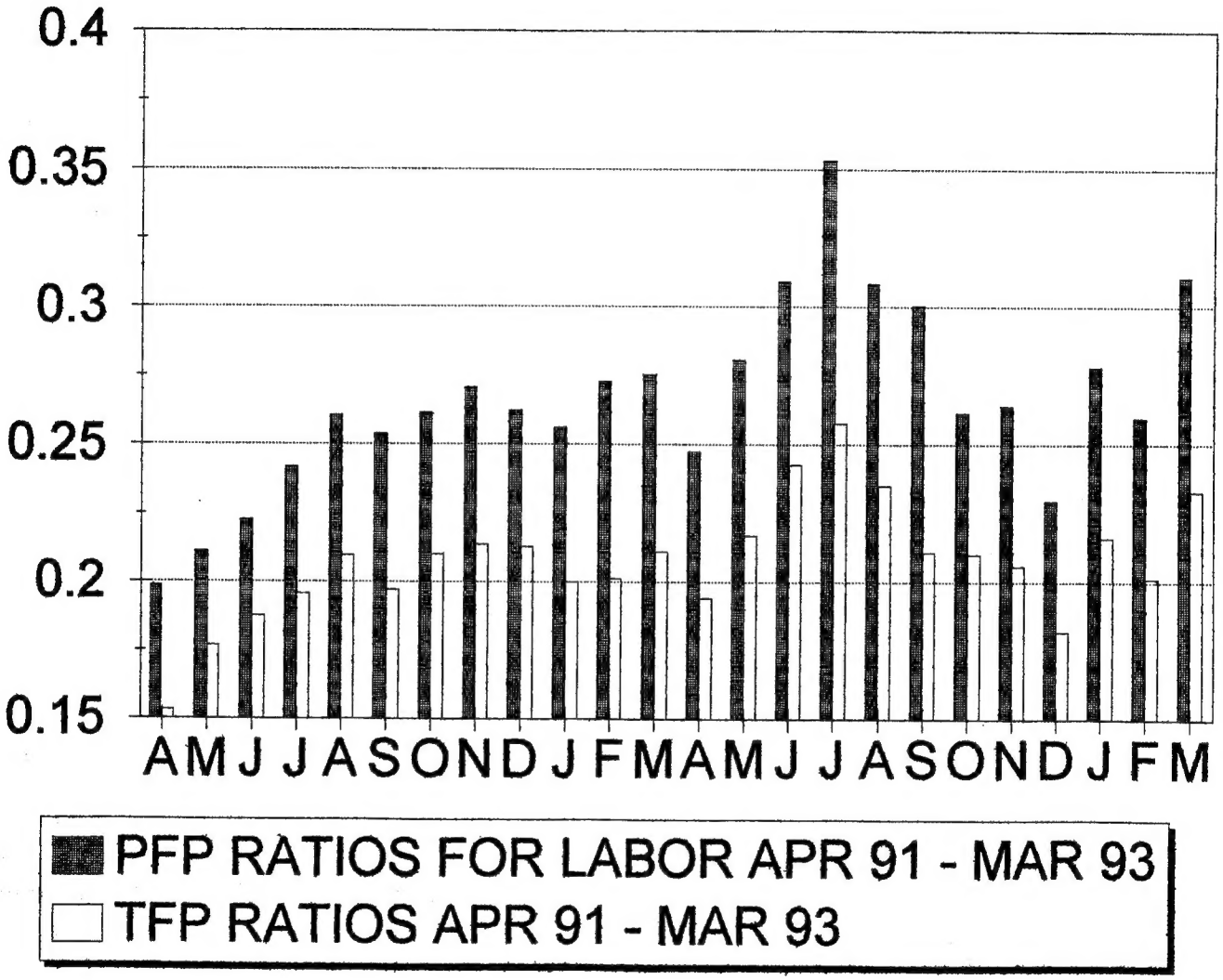

Fig. 5. PFP Ratios for Labor and TFP Ratios Comparison

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